WHAT IS CLAIMED IS:

1. A constant flow rate expansion valve including a restriction having a flow path cross-sectional area smaller than that of a refrigerant inlet, and a differential pressure control valve for providing control such that a differential pressure across the restriction is constant,

characterized in that a downstream side of the restriction and an upstream side of the differential pressure control valve are communicated with each other, and

that the differential pressure control valve is configured to receive an inlet pressure of the refrigerant inlet in a valve-closing direction and at the same time receive an intermediate pressure between the restriction and the differential pressure control valve in a valve-opening direction, with a pressure-receiving portion for receiving the inlet pressure being fluidly isolated by a diaphragm.

2. The constant flow rate expansion valve according to claim 1, wherein the differential pressure control valve includes a valve seat disposed at an intermediate portion of a passage leading from a space between the restriction and the differential pressure control valve to a refrigerant outlet, a valve element disposed in a manner

opposed to the valve seat from a side of the refrigerant outlet such that the valve element can move to and away from the valve seat, and a piston integrally formed with the valve element, and wherein the diaphragm is provided on an opposite end face of the piston to the valve element, in abutment with the end face.

3. The constant flow rate expansion valve according to claim 2, wherein an inner diameter of the valve seat of the differential pressure control valve and an effective pressure-receiving area of the diaphragm are formed to have the same size.

4. The constant flow rate expansion valve according to claim 2, wherein the diaphragm is gastightly sandwiched between a holder axially movably supporting the piston, and a main block having the holder fitted therein.

5. The constant flow rate expansion valve according to claim 1, wherein the diaphragm is formed by a plurality of thin films overlaid upon each other.

6. The constant flow rate expansion valve according to claim 1, wherein the restriction is a refrigerant passage having a fixed flow path cross-sectional area, and

wherein the differential pressure control valve is configured such that a side of the differential pressure

control valve where the inlet pressure is received is urged by a spring via the diaphragm in the valve-closing direction, and a side of the differential pressure control valve where the intermediate pressure is received is urged by a solenoid in the valve-opening direction, with a differential pressure set to the differential pressure control valve being made variable depending on a value of an electric current supplied to the solenoid for energization thereof.

7. The constant flow rate expansion valve according to claim 6, wherein the differential pressure control valve includes a valve element having a frustoconical shape.

8. The constant flow rate expansion valve according to claim 6, wherein the differential pressure control valve includes a valve element having a flat seating surface.

9. The constant flow rate expansion valve according to claim 1, wherein the restriction is a refrigerant passage having a fixed flow path cross-sectional area, and

wherein the differential pressure control valve is configured such that a solenoid is disposed on a side of the differential pressure control valve where the inlet pressure is received, and the differential pressure

control valve is urged via the diaphragm in the valve-closing direction by a spring interposed between a fixed core and a movable core of the solenoid, and that a differential pressure set to the differential pressure control valve can be varied by reducing an urging force of the spring depending on a value of an electric current supplied to the solenoid for energization thereof.

10. The constant flow rate expansion valve according to claim 9, wherein the differential pressure control valve includes a valve element having a frustoconical shape.

11. The constant flow rate expansion valve according to claim 9, wherein the differential pressure control valve includes a valve element having a flat seating surface.

12. The constant flow rate expansion valve according to claim 1, wherein the restriction is configured such that the restriction includes a first valve seat disposed in a passage between the refrigerant inlet and the differential pressure control valve, a first valve element disposed in a manner opposed to the first valve seat from a side of the differential pressure control valve such that the first valve element can move to and away from the first valve seat, and a first spring for urging the first

valve element toward the first valve seat in the valve-closing direction, and that the first valve element is urged by a solenoid in the valve-opening direction, thereby making it possible to vary a flow path cross-sectional area set to the restriction depending on a value of an electric current supplied to the solenoid for energization thereof,

wherein the differential pressure control valve includes a second valve seat disposed at an intermediate portion of a passage leading from the restriction to a refrigerant outlet, a second valve element disposed in a manner opposed to the second valve seat from a side of the refrigerant outlet such that the second valve element can move to and away from the second valve seat, a piston integrally formed with the second valve element, and a second spring for urging the second valve element in the valve-opening direction, the diaphragm being provided on an opposite end face of the piston to the second valve element, in abutment with the end face.

13. The constant flow rate expansion valve according to claim 12, wherein assuming that an effective pressure-receiving area of the first valve element is represented by A, a load set to the first spring is represented by f1, an effective pressure-receiving area of the second valve element is represented by B, and a load set to the second spring is represented by f2, the first valve element, the

first spring, the second valve element, and the second spring are set to have a relationship of f1/A > f2/B.

14. The constant flow rate expansion valve according to claim 1, wherein the restriction is configured such that the restriction includes a first valve seat disposed in a passage between the refrigerant inlet and the differential pressure control valve, a first valve element disposed in a manner opposed to the first valve seat from a side of the differential pressure control valve such that the first valve element can move to and away from the first valve seat, and a spring for urging the first valve element toward the first valve seat in the valve-closing direction, and that the first valve element is urged by a solenoid in the valve-opening direction, thereby making it possible to vary a flow path cross-sectional area set to the restriction depending on a value of an electric current supplied to the solenoid for energization thereof, and

wherein the differential pressure control valve includes a second valve seat disposed at an intermediate portion of a passage leading from the restriction to a refrigerant outlet, a second valve element disposed in a manner opposed to the second valve seat from a side of the refrigerant outlet such that the second valve element can move to and away from the second valve seat, and a piston integrally formed with the second valve element, the

second valve element being urged by the spring in the valve-opening direction, the diaphragm being provided on an opposite end face of the piston to the second valve element, in abutment with the end face.

15. The constant flow rate expansion valve according to claim 14, wherein the solenoid includes a second spring disposed in a manner urging a movable core toward a fixed core and the first valve element, a load of the spring urging the first valve element and the second valve element being indirectly adjusted by adjusting a load of the second spring.

16. The constant flow rate expansion valve according to claim 15, wherein the load of the second spring is adjusted based on an amount of insertion of a press-fit member receiving the second spring on a side opposite to the movable core.

17. The constant flow rate expansion valve according to claim 1, including an elastic valve element disposed for opening and closing the restriction, thereby being capable of completely closing a passage between the refrigerant inlet and a refrigerant outlet.

18. The constant flow rate expansion valve according to claim 1, wherein the restriction is formed by a

refrigerant passage formed between the refrigerant inlet and the differential pressure control valve and having a shaft of a solenoid extending therethrough, the solenoid setting a differential pressure across the differential pressure control valve depending on a value of an electric current supplied thereto for energization thereof, and

wherein the differential pressure control valve includes a valve seat disposed at an intermediate portion of a passage leading from the restriction to a refrigerant outlet, a valve element disposed in a manner opposed to the valve seat from a side of the refrigerant outlet such that the valve element can move to and away from the valve seat, a piston axially movably held in a through hole coaxially formed through the valve element, and having the shaft in abutment with one end face thereof having an outer diameter larger than an inner diameter of the refrigerant passage, the piston having the valve element and the diaphragm in abutment with the other end face thereof, and a spring for urging the piston via the diaphragm in a direction in which the valve element is seated on the valve seat, the piston operating in unison with the valve element when the solenoid is in an energized state, whereas when the solenoid is in a deenergized state, the piston operating even after the valve element has been seated on the valve seat, to close the refrigerant passage.

19. The constant flow rate expansion valve according to claim 18, wherein the piston has an elastic member provided at a portion thereof for closing the refrigerant passage.

20. The constant flow rate expansion valve according to claim 19, wherein the elastic member is a rubber part.

21. The constant flow rate expansion valve according to claim 18, wherein the piston has a stepped portion for catching the valve element to cause the piston to operate in unison therewith, after opening the refrigerant passage by receiving an urging force from the solenoid.

22. The constant flow rate expansion valve according to claim 1, wherein the restriction is a refrigerant passage formed between the refrigerant inlet and the differential pressure control valve and having a fixed flow path cross-sectional area,

wherein the differential pressure control valve includes a valve seat disposed at an intermediate portion of a passage leading from a space between the restriction and the differential pressure control valve to a refrigerant outlet, and a valve element disposed in a manner opposed to the valve seat from a side of the refrigerant outlet such that the valve element can move to and away from the valve seat, the valve element being

urged by a spring via the diaphragm in the valve closing direction from a side of the differential pressure control valve where the inlet pressure is received, and for being urged by a solenoid in the valve-opening direction from a side of the differential pressure control valve where the intermediate pressure is received, the valve element having an extended portion extending through a valve hole to a location close to an outlet of the refrigerant passage, the extended portion controlling a flow path cross-sectional area at the outlet of the refrigerant passage according to changes in pressure of the refrigerant inlet.

23. The constant flow rate expansion valve according to claim 1, applied to a refrigeration cycle using carbon dioxide as refrigerant.

24. The constant flow rate expansion valve according to claim 1, applied to a refrigeration cycle using HFC-152a as refrigerant.